

29 July, 2014

Mr Darren Hill
Yorkley Court Community Farm
Yorkley Lane
Yorkley
Gloucestershire
GL15 4TZ

Our ref: CG/08997

Dear Darren,

Yorkley Court Community Farm - Geoenvironmental report

Introduction

Card Geotechnics Limited (CGL) was instructed by Yorkley Court Community Farm Limited (the Client) to complete a limited geoenvironmental site investigation at Yorkley Court Community Farm in Yorkley, Gloucestershire. This letter report presents factual details of the works undertaken and a review of the environmental risks present at the site.

Background

The land is run as a Community Farm Land Trust by volunteers and a site investigation with respect to soil and groundwater contamination was required to support a planning application to construct low impact dwellings on the site. A site location plan is included as Figure 1.

The site is approximately 10 hectares in area and roughly rectangular in shape. A stream fed by two on-site springs runs along the south eastern boundary and flows to the south. The topography generally slopes towards the stream. In the approximate centre of the site is the "depot area" which comprises an area of hardstanding, two former Ministry of Defence Nissen huts and a smaller associated building. At the rear of the Nissen huts and above ground tank and buried pipes, which potentially fed oil fired boilers, were observed. An area of charred ground, likely from a bonfire, was observed further south west of the depot, along the footpath. The investigation was focussed mainly on these areas. Historical maps show the remainder of the site has not changed land use from woodland/grassland and no evidence of human influence was noted in the remainder of the site during the works or walkover. A review of the available historical maps is given as Appendix A. It is understood that the dwellings are to be located along the ridge along the northern boundary and/or around the depot area.

Methodology

The ground investigation was undertaken on 12th and 13th July 2014 and comprised the excavation of six machine-excavated trial pits (TP1 to TP6) to a maximum depth of 1.4mbgl and one hand-dug trial pit (HP1) to a depth of 0.2mbgl (metres below ground level). Prior to excavation, the locations were cleared by a suitably trained CGL engineer using a Cable Avoidance Tool and a signal generator.

Soil samples were taken from the trial pits and selected samples were sent for a full suite of chemical analyses, including heavy metals, cyanide, total phenols, polyaromatic hydrocarbons, total hydrocarbons and pH. Two

water samples were taken, one from each of the on-site springs (East Spring and West Spring) and these were both sent for the same suite of chemical analyses.

A site layout plan is included as Figure 2 and shows the locations of the trial pits and water samples. Trial pits TP1 to TP3 were located around the depot area and TP4 was located close to the East Spring. TP5 and TP6 were both located along a ridge on the northern boundary of the site. HP1 was located in the northern third of the site where a vegetable garden is present.

In order to characterise the ground conditions, the trial pit arisings were logged by a suitably qualified engineer from CGL. Logs outlining the material encountered are presented in Appendix B and a photographic record is presented in Appendix C. The investigation was undertaken generally in accordance with the requirements set out within BS 5930:1999¹.

Ground conditions

The ground conditions encountered are summarised Table 1 and detailed in the logs in Appendix B.

Table 1. Summary of ground conditions

Stratum	Depth to top of stratum (mbgl)	Typical thickness (m)
Dark brown gravelly silts and clays where the gravel variously comprises brick, concrete and sandstone and is frequently present as cobbles. Frequent roots and rootlets. Strong hydrocarbon odour at TP1.	0.0	0.3 to 1.1
Light grey, yellow brown and red brown blocky gravelly clay. Gravel comprises sandstone and mudstone with frequent sandstone cobbles and boulders. Strong hydrocarbon odour at TP1 and slight hydrocarbon odour at TP3. Organic rich soil and organic odours at TP3. [MADE GROUND]	0.3 to 1.1	>0.3 to >1.0 (base not proved)
Dark brown slightly gravelly SILT. Gravel is of sandstone. Frequent sandstone cobbles, rootlets and plant matter. [TOPSOIL] Encountered at HP1, TP5 and TP6 only.	0.0	0.3
Dark grey yellow SANDSTONE. Sand is fine to coarse. Weathered red brown along fractures at TP6. [PENNANT SANDSTONE] Encountered at TP5 and TP6 only.	0.3	>0.4 to >0.6 (base not proved)

Made Ground was encountered in TP1 to TP4 to a maximum depth of 1.4mbgl where the base could not be proven due to large sandstone cobbles and in some trial pits, boulders. Charred earth was present at the ground surface of TP3 and it was noted that the area became waterlogged during periods of wet weather. The client informed CGL that the area around the East Spring and TP4 also becomes waterlogged during wet weather.

Natural bedrock was encountered along the ridge in TP5 and TP6 below an approximately 300mm thick layer of naturally occurring topsoil. The nature of the hard bedrock meant a limited depth could be achieved in these areas using the excavator. The Pennant Sandstone was observed outcropping along the footpath along the northern boundary of the site where it had previously been locally excavated, most likely for building stone, creating a steep bank to the north of the path.

¹ British Standards Institution. (1999). *Code of practice for site investigations*. BS5930:1999 Inc. Amendment 2.

Results of chemical assessment

The results of the chemical analysis have been assessed and the full laboratory certificates plus assessment table are included in Appendix D.

The groundwater samples were assessed against freshwater Environmental Quality Standards (EQS) and Drinking Water Values (DWV). Both samples passed when assessed against these criteria.

The laboratory test results have been compared against published Soil Guideline Values (SGVs) for the “Residential (with plant uptake)” land-use category to assess the risk to human health from chemical contamination in the soils. Currently, SGVs have only been issued by the Environment Agency for a limited number of contaminants, namely selenium, mercury, arsenic, nickel, the BTEX compounds, phenol, polychlorinated biphenyls and cadmium. The SGVs have all been issued for a sandy loam soil with a Soil Organic Matter of 6% as standard. Where SGVs are not available, the soil results have been compared to Generic Assessment Criteria (GACs) that have been derived in-house by CGL using the Contaminated Land Exposure Assessment (CLEA) model and version 1.06 of the CLEA software. The assessment methodology is detailed further in Appendix D.

The assessment of the soil data has concluded that one Made Ground soil sample from TP1 at 0.7mbgl exceeds the assessment criteria for residential land use, with plant uptake, due to total petroleum hydrocarbons (TPH). Cyanide is also present well above the laboratory limit of detection in this sample. The remaining soil samples tested do not exceed the assessment criteria.

Conclusions and recommendations

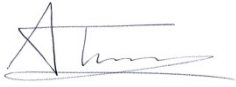
The Made Ground soil in the vicinity of TP1 poses a risk to human health due to TPH, and requires some limited remediation. The remediation strategy should comprise the breaking of the identified pollution linkages by removal of the identified gross contamination source. Potential remediation options include removal of the soils and disposal at a suitable facility, or on site and limited bioremediation treatment of the soils and its re-use on site.

The area of impacted soils appears limited but contamination will need to be ‘chased out and down’ as the area is excavated. An initial 3m by 3m area should be removed to a depth of 1.5mbgl, with further removal of soils visually or olfactory impacted with hydrocarbons. It is recommended that field testing equipment, such as a Petroflag or photo-ionisation detector, be used on-site during the excavation to determine when the grossly impacted soils have been removed. Validation sampling and testing for TPH will be required from the sides and base of the excavation to demonstrate the risk has been removed.

Where natural soils have been encountered, these have been shown to contain concentrations of analysed contaminants below any risk to human health. The historical activity on site has been limited to the depot area and immediate area around it. Neither the site works, nor the historical map review, have indicated that soils other than natural soils are likely to be present in the southern or northern thirds of the site. In particular, the site works have proven natural ground along the southern third, along the ridge, and has proven the soils to not pose a risk to human health.

We trust this meets your requirements. Please do not hesitate to contact me if you have any queries.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Alice Thomas".

Alice Thomas, Engineer
CGL

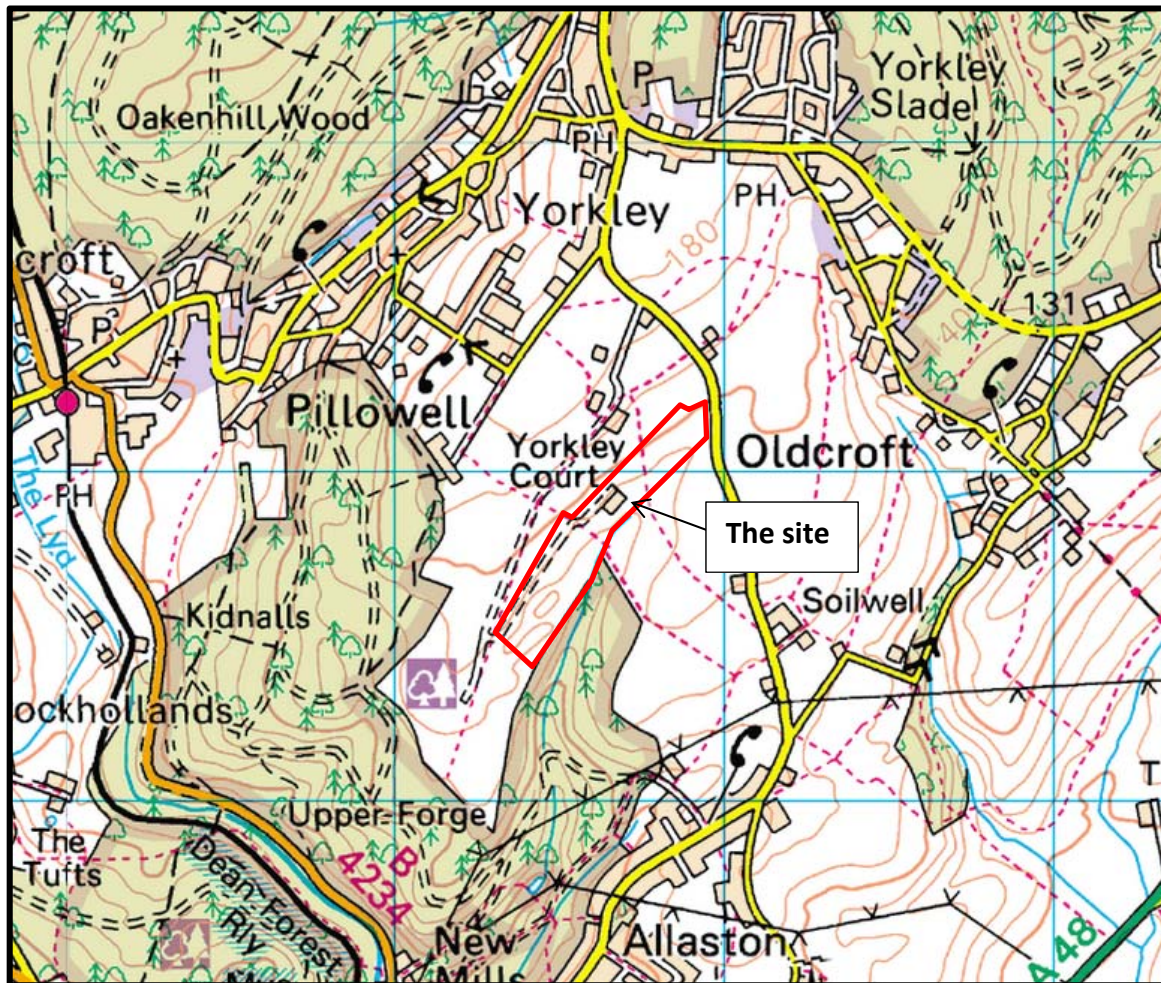
A handwritten signature in black ink, appearing to read "Nick Langdon".

Nick Langdon, Director
CGL

Enclosed.

Figure 1. Site location plan
Figure 2. Site layout plan
Appendix A. Historical map review
Appendix B. Trial Pit logs
Appendix C. Photographic record
Appendix D. Laboratory data

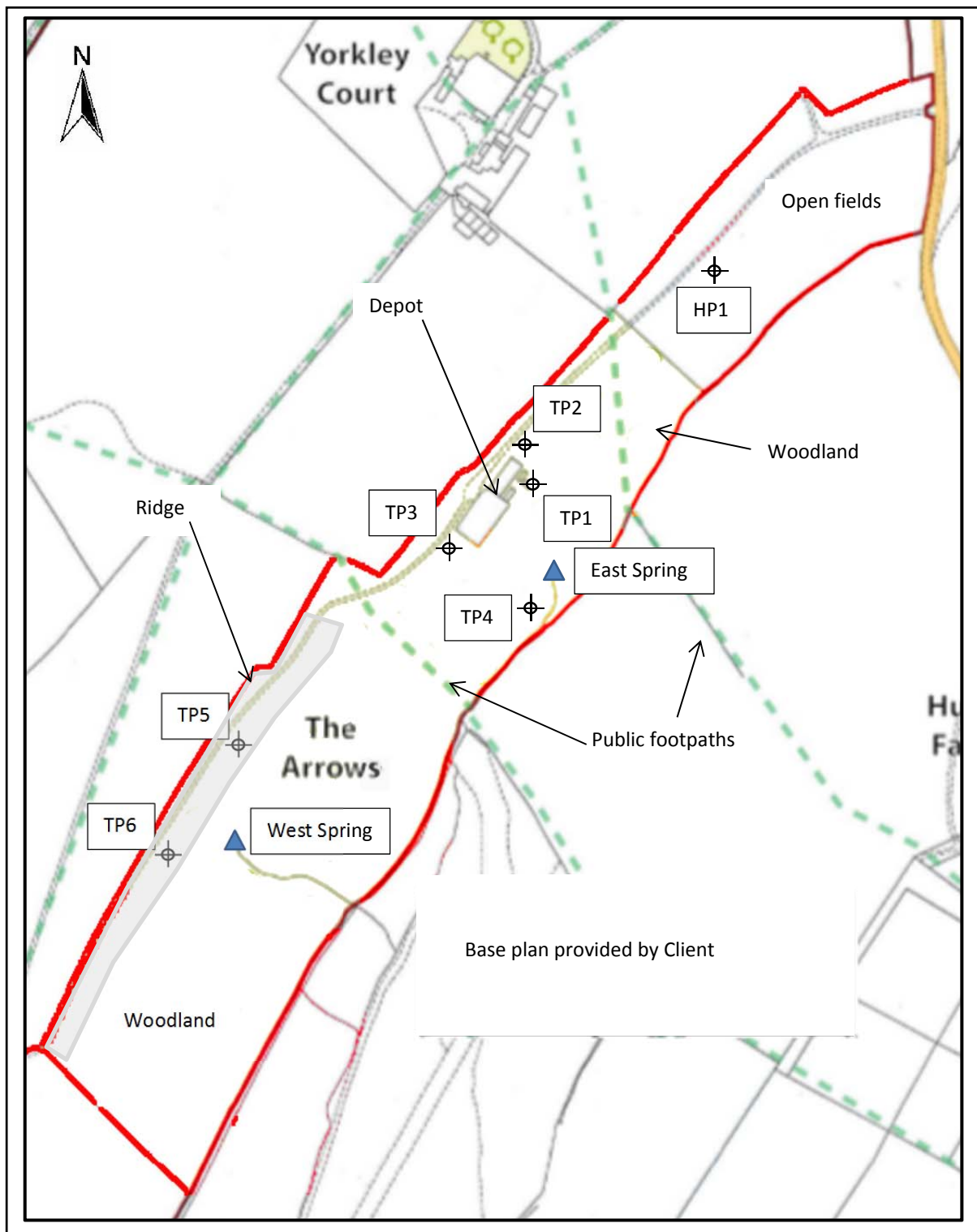
FIGURES



Reproduced from the Ordnance Survey 1:50,000 map with permission of the Controller of Her Majesty's Stationary Office, Crown Copyright.
Not to scale
Licence No. 100012585



Client	Project	Job No
Yorkley Court Community Farm Limited	Yorkley Court Community Farm	CG/08997
	Title	
	Site location plan	Figure 1



Client	Project	Job No
Yorkley Court Community Farm Limited	Yorkley Court Community Farm	CG/08997
	Title	
	Site layout plan	Figure 2

APPENDIX A

Historical map review

APPENDIX A - HISTORICAL MAP REVIEW

Table A. Historical map review.

Year and map type	On site	Off site
1885-1900 OS One Inch	Open fields are shown and a stream runs along the southern boundary.	Woodland is shown along the western half of the southern boundary. Open fields around the rest of the site. Yorkley Court is present to the north in its current location.
1924 OS 1:10560	Woodland is shown in the approximate central third of the site and denoted as <i>Rises</i> . Two springs are shown; one in the location of the present day West Spring, and one approximately 100m north-east. An area of gorse shown as <i>Furze</i> and <i>Rough pasture, heathland and moor</i> is shown south-west of the woodland. The present day public footpaths are shown. A small pond is shown north-east of the woodland.	<i>Collieries</i> , both used and disused, are shown within 1km of the site, as are <i>Old Quarries</i> and <i>Air Shafts</i> . A <i>Brick and Tile Works</i> is shown approximately 600m to the south-east. Woodland and rough pasture is shown along the western half of the southern boundary.
1944 Land Utilisation Map	The site is shown as <i>Meadowland and Permanent Grass</i> in the north-eastern two-thirds of the site, and as <i>Heathland, Moorland and Rough Pasture</i> in the south-western third.	<i>Meadowland and Permanent Grass, Heathland, Moorland and Rough Pasture</i> and <i>Forest and Woodland</i> are shown in the wider area.
1946 Railways, and 1946 Roads	N/A	Railway tracks are shown approximately 1km west and 2.5km east of the site. The B4234 is shown to the west and the B4431 (New Road and Fancy Road in present day) to the east of the site. the A48 is shown to the south.
1978 OS 1:50 000	The depot area is show. A track from Yorkley Lane is shown to the depot.	B4431 is no longer shown as a 'B' road and is not named at this scale.
2013 OS 1:10000	The northern third of the site is shown as an open field and the remainder of the site as rough pasture. The track from Yorkley Lane is shown along the whole length of the northern boundary. Two springs are shown in the present day locations of the East and West Springs.	No significant changes.

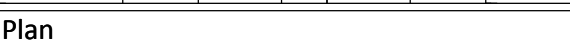
APPENDIX B

Trial pit logs

CGI
Card Geotechnics Limited

Project Yorkley Court Community Farm, Gloucestershire				TRIAL PIT No HP1
Job No CG/08997	Date 16-07-14	Ground Level (m)	Co-Ordinates (m)	
Client Yorkley Court Community Farm				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
0.10	ES				× — × × × × — ×	0.20	Soft dark brown slightly clayey SILT. Frequent rootlets. [TOPSOIL]
							(Pit terminated at 0.2m)

Plan  Stability: Good	General Remarks 1. Hand pit terminated at 0.2mbgl. 2. No groundwater encountered. 3. ES = Environmental sample. 4. Backfilled upon completion.
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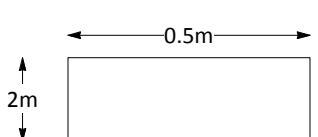
Method/ Plant Used	Hand excavated	Field Crew	Logged By AMT	Checked By NJL
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CGL TP LOG CG08997.GPJ GINT STD AGS 3_1.GDT 29/7/14

TRIAL PIT LOG

Project Yorkley Court Community Farm, Gloucestershire				TRIAL PIT No TP1
Job No CG/08997	Date 12-07-14	Ground Level (m)	Co-Ordinates (m)	
Client Yorkley Court Community Farm				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
0.10	ES					(0.60) 0.60	Dark brown slightly gravelly silt. Gravel is subangular to subrounded, fine to coarse of brick and concrete. Frequent lengths of cable, brick cobbles, roots and rootlets. [MADE GROUND]
0.70	ES					(0.50) 1.10	Dark grey brown gravelly clay. Gravel is subangular to subrounded, fine to coarse of brick and concrete. Frequent roots and occasional wood fragments. [MADE GROUND] 0.70 Strong hydrocarbon odour.
1.40	ES					(0.30) 1.40	Light grey and yellow brown blocky slightly gravelly clay. Gravel is subangular to subrounded, fine to medium of sandstone. Occasional sandstone cobbles and boulders. [MADE GROUND] 1.10 Strong hydrocarbon odour and water seepage. (Pit terminated at 1.4m)

Plan  Stability: Good	General Remarks 1. Trial pit terminated at 1.4mbgl. 2. Groundwater seepage noted at 1.1mbgl. 3. ES = Environmental sample. 4. Backfilled upon completion.
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Method/ Plant Used Tracked Excavator	Field Crew	Logged By AMT	Checked By NJL
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TRIAL PIT LOG



Project Yorkley Court Community Farm, Gloucestershire				TRIAL PIT No TP2
Job No CG/08997	Date 12-07-14	Ground Level (m)	Co-Ordinates (m)	
Client Yorkley Court Community Farm				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
0.60	ES					(0.70) 0.70	Light grey brown gravelly silt. Gravel is subangular to subrounded, fine to coarse of brick, concrete and sandstone. Frequent brick, concrete and sandstone cobbles, and frequent roots. Rare pieces of light grey and yellow brown clay. [MADE GROUND]
1.00	ES					(0.60) 1.30	Firm, light grey and yellow brown and red brown blocky gravelly clay. Gravel is subangular to subrounded, fine to coarse of sandstone and mudstone. Frequent sandstone cobbles and boulders. [MADE GROUND]
							(Pit terminated at 1.3m)

Plan	General Remarks
Stability: Good	1. Trial pit terminated at 1.3mbgl. 2. No groundwater encountered. 3. ES = Environmental sample. 4. Backfilled upon completion.

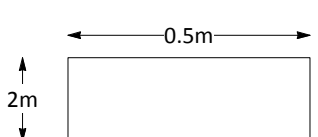
Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked Excavator		AMT	NJL

CGI_TP_LOG CG08997.GPJ GINT STD AGS 3_1.GDT 29/7/14

TRIAL PIT LOG

Project Yorkley Court Community Farm, Gloucestershire				TRIAL PIT No TP3
Job No CG/08997	Date 12-07-14	Ground Level (m)	Co-Ordinates (m)	
Client Yorkley Court Community Farm				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
0.20	ES					(0.30) 0.30	Dark brown gravelly clayey peat. Gravel is subangular to subrounded, fine to coarse of brick and concrete. Frequent rootlets, wood fragments and pieces of plastic. [MADE GROUND]
0.50	ES					(1.00) 1.30	Light grey and yellow brown and red brown blocky gravelly clay. Gravel is subangular to subrounded, fine to coarse of sandstone and mudstone. Occasional sandstone cobbles. [MADE GROUND] 0.30 - 0.70 Strong organic odour and slight hydrocarbon odour. Frequent wood fragments. 0.60 Groundwater seepage noted at 0.6mbgl.
							(Pit terminated at 1.3m)

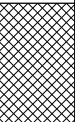
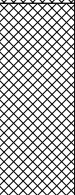
Plan  Stability: Good	General Remarks 1. Trial pit terminated at 1.3mbgl. 2. Groundwater seepage noted at 0.6mbgl. 3. ES = Environmental sample. 4. Backfilled upon completion.
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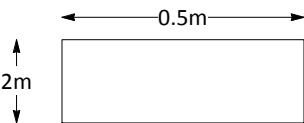
Method/ Plant Used Tracked Excavator	Field Crew	Logged By AMT	Checked By NJL
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TRIAL PIT LOG



Project Yorkley Court Community Farm, Gloucestershire				TRIAL PIT No TP4
Job No CG/08997	Date 13-07-14	Ground Level (m)	Co-Ordinates (m)	
Client Yorkley Court Community Farm				Sheet 1 of 1

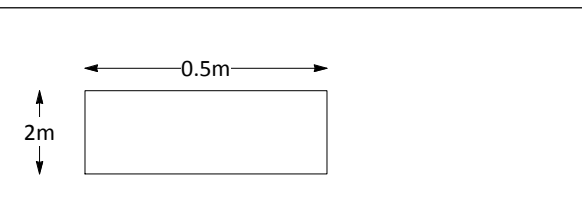
SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
1.30	ES					(0.50) 0.50	Light brown gravelly silt. Gravel is subangular to subrounded, fine to coarse of brick and sandstone. Frequent roots and rootlets. Occasional light grey and yellow brown clay pieces. [MADE GROUND]
						(0.80) 1.30	Light grey and red brown and yellow brown slightly gravelly clay. Gravel is subangular to rounded, fine to coarse of mudstone and sandstone. Frequent sandstone cobbles and occasional boulders. [MADE GROUND]
							(Pit terminated at 1.3m)

Plan	General Remarks
 Stability: Good	1. Trial pit terminated at 1.3mbgl. 2. No groundwater encountered. 3. ES = environmental sample. 4. Backfilled upon completion.

Method/ Plant Used	Tracked Excavator	Field Crew	Logged By AMT	Checked By NJL
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CGI TP LOG CG08997 GPJ GINT STD AGS 3_1 GDT 29/7/14

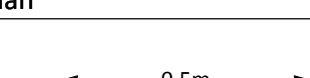
CGL TP LOG CG08997.GPJ GINT STD AGS 3 1.GDT 29/7/14

Plan  Stability: Good	General Remarks
	1. Trial pit terminated at 0.7mbgl due to natural bedrock. 2. No groundwater encountered. 3. ES = environmental sample. 4. Backfilled upon completion.

Method/ Plant Used	Tracked Excavator	Field Crew	Logged By AMT	Checked By NJL
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Project Yorkley Court Community Farm, Gloucestershire				TRIAL PIT No TP6
Job No CG/08997	Date 13-07-14	Ground Level (m)	Co-Ordinates (m)	
Client Yorkley Court Community Farm				Sheet 1 of 1

[illegible]

Plan	General Remarks
 Stability: Good	1. Trial pit terminated at 0.9mbgl due to natural bedrock. 2. No groundwater encountered. 3. ES = environmental sample. 4. Backfilled upon completion.

Method/ Plant Used	Tracked Excavator	Field Crew	Logged By AMT	Checked By NJL
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CGCL TP LOG CG08997.GPJ GINT STD AGS 3_1.GDT 29/7/14

APPENDIX C

Photographic record

PHOTO SHEET

Date	Job No	Made by	Checked by	Sheet No
July 2014	CG/08997	AMT	bwl	01



Photo 1. Trial Pit 1 immediately south of the depot.



Photo 2. Trial Pit 2 in the vicinity of above ground fuel tank and barrels to the east of the depot.

Notes

PHOTO SHEET

Date	Job No	Made by	Checked by	Sheet No
July 2014	CG/08997	AMT	bW[	02



Photo 3. Trial Pit 3 in the area of charred earth to the west of the depot.



Photo 4. Trial Pit 4 by the East Spring.

Notes

PHOTO SHEET

Date	Job No	Made by	Checked by	Sheet No
July 2014	CG/08997	AMT	bw[	03



Photo 5. Location of Trial Pit 5 along the ridge.



Photo 6. Natural soil and bedrock within Trial Pit 5.

Notes

PHOTO SHEET

Date	Job No	Made by	Checked by	Sheet No
July 2014	CG/08997	AMT	bwl	04



Photo 6. Natural soil and bedrock at Trial Pit 6, showing red brown weathering.



Photo 7. West Spring

Notes

APPENDIX D

Laboratory data

**Alice Thomas**

Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW

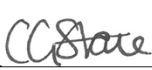
t: 01483 310600
f: 01483 527285
e: alicet@cgl-uk.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 14-57357

Project / Site name:	Yorkley Court	Samples received on:	17/07/2014
Your job number:	CG-08997	Samples instructed on:	17/07/2014
Your order number:	1096	Analysis completed by:	28/07/2014
Report Issue Number:	1	Report issued on:	28/07/2014
Samples Analysed:	1 soil sample		

Signed: 

Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.



Signed:
Rexona Rahman
Customer Services Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 14-57357

Project / Site name: Yorkley Court

Your Order No: 1096

Lab Sample Number				356319				
Sample Reference				HP1				
Sample Number				None Supplied				
Depth (m)				0.10				
Date Sampled				16/07/2014				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	18				
Total mass of sample received	kg	0.001	NONE	0.49				

General Inorganics

pH	pH Units	N/A	MCERTS	6.9				
Total Cyanide	mg/kg	1	MCERTS	< 1				
Total Sulphate as SO ₄	mg/kg	100	ISO 17025	590				
Organic Matter	%	0.1	MCERTS	4.6				

Total Phenols

Total Phenols (monohydric)	mg/kg	2	MCERTS	< 2.0				
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10				
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10				
Fluorene	mg/kg	0.1	MCERTS	< 0.10				
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10				
Anthracene	mg/kg	0.1	MCERTS	< 0.10				
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Pyrene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10				
Chrysene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10				
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10				
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05				
Coronene	mg/kg	0.05	NONE	< 0.05				

Total PAH

Total WAC-17 PAHs	mg/kg	1.6	NONE	< 1.6				
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.4				
Barium (aqua regia extractable)	mg/kg	1	MCERTS	82				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.8				
Boron (water soluble)	mg/kg	0.2	MCERTS	0.9				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	35				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	22				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	31				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	25				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	130				

Analytical Report Number: 14-57357

Project / Site name: Yorkley Court

Your Order No: 1096

Lab Sample Number				356319				
Sample Reference				HP1				
Sample Number				None Supplied				
Depth (m)				0.10				
Date Sampled				16/07/2014				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0				
TPH-CWG - Aliphatic >EC21 - EC40	mg/kg	10	NONE	< 10				
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10				
TPH-CWG - Aromatic >EC21 - EC40	mg/kg	10	NONE	< 10				



Analytical Report Number : 14-57357

Project / Site name: Yorkley Court

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and topsoil/loam soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content

of a sample is calculated as the % weight of the stones not passing a 2 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
356319	HP1	None Supplied	0.10	Brown sandy topsoil with gravel and vegetation.



Analytical Report Number : 14-57357

Project / Site name: Yorkley Court

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	ISO 17025
TPHCWG (Soil)	Determination of pentane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 300°C.

**Alice Thomas**

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Analytical Report Number : 14-57240

Project / Site name:	Yorkley Court	Samples received on:	14/07/2014
Your job number:	CG-08997	Samples instructed on:	14/07/2014
Your order number:	1096	Analysis completed by:	23/07/2014
Report Issue Number:	1	Report issued on:	23/07/2014
Samples Analysed:	5 soil samples - 2 water samples		

Signed:

Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Rexona Rahman
Customer Services Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.



Analytical Report Number: 14-57240

Project / Site name: Yorkley Court

Your Order No: 1096

Lab Sample Number				355608	355609	355610	355611	355612
Sample Reference				TP1	TP2	TP3	TP4	TP5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.70	0.60	0.50	1.30	0.70
Date Sampled				12/07/2014	12/07/2014	12/07/2014	13/07/2014	13/07/2014
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	9.5	7.7	15	18	12
Total mass of sample received	kg	0.001	NONE	0.51	0.52	0.50	0.51	0.51

General Inorganics

pH	pH Units	N/A	MCERTS	8.2	8.7	8.6	7.9	8.2
Total Cyanide	mg/kg	1	MCERTS	93	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	100	ISO 17025	4200	470	320	540	180
Organic Matter	%	0.1	MCERTS	2.3	1.6	1.7	2.9	2.5

Total Phenols

Total Phenols (monohydric)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	1.6	NONE	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.6	5.4	4.7	5.6	5.9
Barium (aqua regia extractable)	mg/kg	1	MCERTS	100	160	99	74	140
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.9	1.2	1.2	0.5	1.0
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1	0.6	0.6	0.6	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14	16	17	12	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	19	24	27	6.2	8.9
Lead (aqua regia extractable)	mg/kg	1	MCERTS	14	15	11	23	20
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	30	32	12	24
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	53	18	17	17	19
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	53	65	41	29	47



Analytical Report Number: 14-57240

Project / Site name: Yorkley Court

Your Order No: 1096

Lab Sample Number				355608	355609	355610	355611	355612
Sample Reference				TP1	TP2	TP3	TP4	TP5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.70	0.60	0.50	1.30	0.70
Date Sampled				12/07/2014	12/07/2014	12/07/2014	13/07/2014	13/07/2014
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	3.5	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	240	10	13	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	530	32	22	< 8.0	9.5
TPH-CWG - Aliphatic >EC21 - EC40	mg/kg	10	NONE	2100	120	41	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	64	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	310	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC40	mg/kg	10	NONE	1200	14	< 10	< 10	< 10



Analytical Report Number: 14-57240

Project / Site name: Yorkley Court

Your Order No: 1096

Lab Sample Number	355613	355614			
Sample Reference	East Spring	West Spring			
Sample Number	None Supplied	None Supplied			
Depth (m)	None Supplied	None Supplied			
Date Sampled	13/07/2014	13/07/2014			
Time Taken	None Supplied	None Supplied			
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	6.5	7.1			
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10			
Sulphate as SO ₄	µg/l	45	ISO 17025	38200	17000			
Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	115	92.0			

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10			
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			

Total PAH

Total EPA-16 PAHs	µg/l	0.2	ISO 17025	< 0.20	< 0.20			
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.62	0.46			
Barium (dissolved)	µg/l	0.06	ISO 17025	230	250			
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1			
Boron (dissolved)	µg/l	10	ISO 17025	49	33			
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.05	0.03			
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.2			
Copper (dissolved)	µg/l	0.5	ISO 17025	2.6	2.0			
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2			
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05			
Nickel (dissolved)	µg/l	0.5	ISO 17025	2.8	< 0.5			
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6	< 0.6			
Vanadium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2			
Zinc (dissolved)	µg/l	0.5	ISO 17025	13	8.8			

Calcium (dissolved)	mg/l	0.005	ISO 17025	24.3	19.5			
Magnesium (dissolved)	mg/l	0.002	ISO 17025	13	11			

Petroleum Hydrocarbons



Analytical Report Number: 14-57240

Project / Site name: Yorkley Court

Your Order No: 1096

Lab Sample Number				355613	355614			
Sample Reference				East Spring	West Spring			
Sample Number				None Supplied	None Supplied			
Depth (m)				None Supplied	None Supplied			
Date Sampled				13/07/2014	13/07/2014			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					
TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10			

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 14-57240

Project / Site name: Yorkley Court

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and topsoil/loam soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of

a sample is calculated as the % weight of the stones not passing a 2 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
355608	TP1	None Supplied	0.70	Brown clay and sand with gravel and rubble.
355609	TP2	None Supplied	0.60	Brown topsoil and clay with gravel and rubble.
355610	TP3	None Supplied	0.50	Brown clay and sand.
355611	TP4	None Supplied	1.30	Brown clay and topsoil with vegetation.
355612	TP5	None Supplied	0.70	Light brown sandy topsoil with vegetation.

Analytical Report Number : 14-57240

Project / Site name: Yorkley Court

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Boron in water	Determination of boron by acidification followed by ICP-MS. Accredited matrices: SW, GW.	In-house method based on MEWAM	L012-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L012-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
pH in water	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L070-UK	W	ISO 17025
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025

ISS No 14-57240-1

Analytical Report Number : 14-57240

Project / Site name: Yorkley Court

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	ISO 17025
TPHCWG (Soil)	Determination of pentane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-UK	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

1. RESIDENTIAL WITH PLANT UPTAKE

1.1 Risks to human health (long-term chronic risks)

The laboratory test results have been compared against the published *Soil Guideline Values* (SGVs) for the “*Residential (with plant uptake)*” land-use category to assess the risk to human health from chemical contamination in the soils. Currently, SGVs have only been issued by the Environment Agency for a limited number of contaminants, namely selenium, mercury, arsenic, nickel, the BTEX compounds, phenol, polychlorinated biphenyls and cadmium. The SGVs have all been issued for a sandy loam soil with a Soil Organic Matter of 6% as standard.

Where SGVs are not available, the soil results have been compared to *Generic Assessment Criteria* (GACs) that have been derived in-house by CGL using the *Contaminated Land Exposure Assessment (CLEA)* model¹ and version 1.06 of the CLEA software. The GACs represent conservative screening criteria and have been calculated using the default parameters for the standard land use scenario set out in the CLEA technical report and toxicological inputs in line with the requirements of *Science Report SC050021/SR2*² and, in the case of petroleum hydrocarbons, *Science Report P5-080/TR3*³. The GACs have been generated assuming a sandy loam soil type and a Soil Organic Matter of 2.5%, which are suitable assumptions for the site in question. More detailed information on the derivation of the CGL GACs can be provided upon request.

The results of the assessment are set out below in Tables D1 and D2. Assessment against the SGVs and GACs is carried out at the 95th percentile on the sample mean (designated US₉₅), which is considered to represent a reasonable worst-case scenario. Statistical assessment of the results has been completed in accordance with the recommendations set out in the recently published CL:AIRE guidance⁴. In this regard, an assessment of the normality of the data has been undertaken.

¹ Environment Agency. (January 2009). *Updated technical background to the CLEA model*. Science Report SC050021/SR3.

² Environment Agency. (January 2009). *Human health toxicological assessment of contaminants in soil*. Science Report SC050021/SR2.

³ Environment Agency. (February 2005). *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils*. Science Report P5-080/TR3.

⁴ J. Lowe et al. (May 2008). *Guidance on comparing soil contamination data with a critical concentration*. CL:AIRE, CIEH & SAGTA.

Where datasets are normally distributed the *one sample t-test* has been applied to calculate the US_{95} . In the case of non-parametric datasets, the Chebychev Theorem has been applied. The Grubbs Test has also been used to identify potential outliers within datasets. Copies of the relevant statistical analysis are available on request.

In March 2014, the Department for Environment, Food and Regional Affairs (DEFRA) issued SP1010 Development of Category 4 Screening Levels (C4SLs) for assessment of land affected by contamination - Policy companion document⁵, along with the results of the work by the C4SLs development team⁶. This includes a set of C4SL values for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead for sandy loam soil with SOM =6%.

These values are primarily to support site assessment with respect to Part IIA of the Environmental Protection Act 1990, being indicative of low health risk and therefore of a site not determinable under Part 2A. This is in comparison with the SGVs and GACs which represent minimal risk. The C4SLs are based on revised slightly less conservative exposure models and toxicology based on Low Level of Toxicological Concern (LLTC) rather than the Heath Criteria Values (HCV) on which the SGVs/GACs are based. The difference in risk level between HCV (minimal risk) and LLTC (low risk) is slight, and it is noted that both are still within the Category 4 level and below the Category 3/4 level boundary considered by DEFRA to be the likely de facto minimum standard chosen by developers. The C4SLs are still strongly conservative in accordance with the Contaminated Land Regulations and meet the objectives of the NPPF that:

- *the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation; and*
- *after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.*

⁵ DEFRA (March 2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document

⁶ CL:AIRE (March 2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination

On this basis CGL considers it is appropriate to use C4SLs for the published contaminants. In the event impacts are identified on a site above the GAC/SGV level for these contaminants, CGL will utilise the C4SLs to assess whether these pose a low risk to developments and Public Open Space applications.

It is noted that the BGS has published background levels for a number of organic and inorganic constituents. In the event that the C4SL or a GAC is found to be exceeded, the risk may still be considered to be low, unlikely to meet the definition of contaminated land under Part IIA and potentially suitable for use from a development perspective, if the contaminant concentrations are below local background levels, assuming no other contributing factors.

It is noted that the SGV for lead has been withdrawn and that the C4SL for lead will be used in its place, based on latest toxicology research, or a CGL site specific GAC may be used, derived using the SGV exposure model and latest published toxicology.

Table D1a Summary of soil contamination (risks to human health) – Made Ground

Contaminant	SGV or GAC @ 2.5% SOM for Residential (with plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL) ¹	Measured range (mg/kg)	Max value > Assessment Criteria? (Y/N)
SOM (%)	* ²		1.6 to 2.9	*
Arsenic	32 ³	-	4.7 to 7.6	N
Cadmium	10 ³	-	<0.2	N
Chromium (total)	37	-	12 to 17	N
Lead	200 ⁵	-	11 to 23	N
Mercury (inorganic)	170 ³	-	<0.3	N
Selenium	350 ³	-	<1	N
Boron	*		0.6 to 1.1	*
Copper	3,700	-	6.2 to 27	N
Nickel	130 ³	-	12 to 32	N
Zinc	18,000	-	29 to 65	N
Barium	*		74 to 160	*
Beryllium	23	-	0.5 to 1.2	N
Vanadium	130	-	17 to 53	N
Phenols ⁴	290 ³	-	<2	N
Cyanide	*		<1 to 93	*

Notes:

- = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.
- * = no value currently defined
- Based on published Soil Guideline Value (Environment Agency, 2009), adjusted for 2.5% SOM
- GAC relates to Phenol (C₆H₅OH) only.
- Published C4SL for lead (DEFRA, 2014)

Table D1b Summary of soil contamination (risks to human health) – Made Ground cont..

Contaminant	SGV or GAC @ 2.5% SOM for Residential (with plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL) ¹	Measured range (mg/kg)	Max value > Assessment Criteria? (Y/N)
Total Petroleum Hydrocarbons (TPH)				
TPH aliphatic EC5-6	41	-	<0.1	N
TPH aliphatic EC>6-8	100	-	<0.1	N
TPH aliphatic EC>8-10	25	-	<0.1	N
TPH aliphatic EC>10-12	420	(b)	<1 to 3.5	N
TPH aliphatic EC>12-16	4,300	(b)	<2 to 240	N
TPH aliphatic EC>16-35	88,000	(b)	<8 to 2630	N
TPH aromatic EC5-7	0.16	-	<0.1	N
TPH aromatic EC>7-8	270	-	<0.1	N
TPH aromatic EC>8-10	37	-	<0.1	N
TPH aromatic EC>10-12	130	-	<1	N
TPH aromatic EC>12-16	290	-	<2 to 64	N
TPH aromatic EC>16-21	490 [150]	(a)	<10 to 310	N
TPH aromatic EC>21-35	1,100 [12]	(a)	<10 to 1200	Y
Polycyclic Aromatic Hydrocarbons (PAH)				
Acenaphthene	1,200	(b)	<0.1	N
Anthracene	13,000 [19]	(a)	<0.1	N
Benzo(a)anthracene	13 [4.3]	(a)	<0.1	N
Benzo(a)pyrene	2.4 [2.3]	(a)	<0.1	N
Benzo(b)fluoranthene	23 [3.0]	(a)	<0.1	N
Benzo(g,h,i)perylene	240 [0.05]	(a)	<0.05	N
Benzo(k)fluoranthene	24 [1.7]	(a)	<0.1	N
Chrysene	200 [1.1]	(a)	<0.05	N
Dibenzo(a,h)anthracene	2.3 [0.01]	(a)	<0.1	N
Fluoranthene	1,500 [47]	(a)	<0.1	N
Fluorene	1,200 [381]	(a)	<0.1	N
Indeno(1,2,3-cd)pyrene	23 [0.15]	(a)	<0.1	N
Naphthalene	3.7	-	<0.05	N
Pyrene	1,000 [5.5]	(a)	<0.1	N

Notes:

- = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.

Table D2a Summary of soil contamination (risks to human health) – Natural Ground

Contaminant	SGV or GAC @ 2.5% SOM for Residential (with plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL) ¹	Measured range (mg/kg)	Max value > Assessment Criteria? (Y/N)
SOM (%)	* ²		2.5 to 4.6	*
Arsenic	32 ³	-	5.9 to 8.4	N
Cadmium	10 ³	-	<0.2 to 0.3	N
Chromium (total)	37	-	16 to 35	N
Lead	200 ⁵	-	20 to 31	N
Mercury (inorganic)	170 ³	-	<0.3	N
Selenium	350 ³	-	<1	N
Boron	*		0.3 to 0.9	*
Copper	3,700	-	8.9 to 22	N
Nickel	130 ³	-	24	N
Zinc	18,000	-	47 to 130	N
Barium	*		82 to 140	*
Beryllium	23	-	0.8 to 1.0	N
Vanadium	130	-	19 to 25	N
Phenols ⁴	290 ³	-	<2	N
Cyanide	*		<1	*

Notes:

- = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.
- * = no value currently defined
- Based on published Soil Guideline Value (Environment Agency, 2009), adjusted for 2.5% SOM
- GAC relates to Phenol (C₆H₅OH) only.
- Published C4SL for lead (DEFRA, 2014)

Table D2b Summary of soil contamination (risks to human health) – Natural Ground cont..

Contaminant	SGV or GAC @ 2.5% SOM for Residential (with plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL) ¹	Measured range (mg/kg)	Max value > Assessment Criteria? (Y/N)
Total Petroleum Hydrocarbons (TPH)				
TPH aliphatic EC5-6	41	-	<0.1	N
TPH aliphatic EC>6-8	100	-	<0.1	N
TPH aliphatic EC>8-10	25	-	<0.1	N
TPH aliphatic EC>10-12	420	(b)	<1	N
TPH aliphatic EC>12-16	4,300	(b)	<2	N
TPH aliphatic EC>16-35	88,000	(b)	<8 to 9.5	N
TPH aromatic EC5-7	0.16	-	<0.1	N
TPH aromatic EC>7-8	270	-	<0.1	N
TPH aromatic EC>8-10	37	-	<0.1	N
TPH aromatic EC>10-12	130	-	<1	N
TPH aromatic EC>12-16	290	-	<2	N
TPH aromatic EC>16-21	490 [150]	(a)	<10	N
TPH aromatic EC>21-35	1,100 [12]	(a)	<10	N
Polycyclic Aromatic Hydrocarbons (PAH)				
Acenaphthene	1,200	(b)	<0.1	N
Anthracene	13,000 [19]	(a)	<0.1	N
Benzo(a)anthracene	13 [4.3]	(a)	<0.1	N
Benzo(a)pyrene	2.4 [2.3]	(a)	<0.1	N
Benzo(b)fluoranthene	23 [3.0]	(a)	<0.1	N
Benzo(g,h,i)perylene	240 [0.05]	(a)	<0.05	N
Benzo(k)fluoranthene	24 [1.7]	(a)	<0.1	N
Chrysene	200 [1.1]	(a)	<0.05	N
Dibenzo(a,h)anthracene	2.3 [0.01]	(a)	<0.1	N
Fluoranthene	1,500 [47]	(a)	<0.1	N
Fluorene	1,200 [381]	(a)	<0.1	N
Indeno(1,2,3-cd)pyrene	23 [0.15]	(a)	<0.1	N
Naphthalene	3.7	-	<0.05	N
Pyrene	1,000 [5.5]	(a)	<0.1	N

Notes:

- = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.